

**SYSTEM AND METHOD FOR MANAGING MULTIPLE INFORMATION  
HANDLING SYSTEMS USING EMBEDDED CONTROL LOGIC**

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**SYSTEM AND METHOD FOR MANAGING MULTIPLE INFORMATION  
HANDLING SYSTEMS USING EMBEDDED CONTROL LOGIC**

TECHNICAL FIELD

The present disclosure relates in general to an  
information handling system, and more particularly to a  
system and method for managing multiple information  
5 handling systems using embedded control logic.

BACKGROUND

As the value and use of information continues to increase, individuals and businesses seek additional ways to process and store information. One option available  
5 to users is information handling systems. An information handling system generally processes, compiles, stores, and/or communicates information or data for business, personal, or other purposes thereby allowing users to take advantage of the value of the information. Because  
10 technology and information handling needs and requirements vary between different users or applications, information handling systems may also vary regarding what information is handled, how the information is handled, how much information is  
15 processed, stored, or communicated, and how quickly and efficiently the information may be processed, stored, or communicated. The variations in information handling systems allow for information handling systems to be general or configured for a specific user or specific use  
20 such as financial transaction processing, airline reservations, enterprise data storage, or global communications. In addition, information handling systems may include a variety of hardware and software components that may be configured to process, store, and  
25 communicate information and may include one or more computer systems, data storage systems, and networking systems.

In some applications, multiple information handling systems may be used simultaneously. For example, data  
30 centers may include multiple web servers, mail servers,

general purpose servers, storage servers and similar devices mounted in vertical racks. These information handling systems may be managed by information technology (IT) personal in a many to one relationship such that a  
5 single IT person may manage the multiple information handling systems. Typically, the IT person uses a Keyboard, Video and Mouse (KVM) switch to connect multiple servers to a single mouse, keyboard and video monitor in a point-to-point topology.

10 The point-to-point topology, however, requires three (3) cables (e.g., one cable for each of the mouse, video and monitor functions) to connect each of the information handling systems to the KVM switch. In a rack including, for example, forty (40) servers, there may be as many as  
15 one-hundred twenty (120) cables used to connect the information handling systems to the KVM switch. Since many data centers include large numbers of information handling systems, cable management is quickly becoming a large problem. Additionally, most KVM switches may only  
20 support a maximum of eight (8) information handling systems. In a rack including more than eight (8) information handling systems, the appropriate number of additional KVM switches must be added to the data center. The KVM switches additionally may occupy one slot in the  
25 rack, thus reducing the number of information handling systems that may be included in the rack.

One solution to reducing the number of cables used to connect multiple information handling systems to a KVM switch is to use a master switch card coupled to multiple  
30 slave cards. The master switch card may be located in

the first information handling system in the rack (e.g., the information handling system located in the top slot of the rack). The master card is then coupled to a slave card in the next information handling system in the rack  
5 by a single cable. The remaining information handling systems include slave cards that are connected by daisy chaining the systems together. In this solution, the master card is directly connected to a management system being used to monitor the data center. This direct  
10 connection is undesirable because the operation of the entire system is dependent upon the master card. If the master card fails or the information handling system containing the master card loses power, the management system cannot receive any information from any of the  
15 information handling systems in the rack.

In another solution, each information handling system may include a local management card that converts each of information handling system's signals into encoded and packetized signals carried over a cable.  
20 This solution eliminates the problem of relying on a master card to control the entire system but increases the cost of the system because complex circuitry is required to generate the packetized signals.

SUMMARY

In accordance with the present invention, the disadvantages and problems associated with managing multiple information handling systems have been  
5 substantially reduced or eliminated. In a particular embodiment, embedded control logic included in an information handling system selects first analog video signals received by a first port or second analog video signals generated by the information handling system for  
10 transmission to a master controller.

In accordance with one embodiment of the present invention, an information handling system includes a first port for receiving first analog video signals and embedded control logic operably coupled to the first  
15 port. The embedded control logic selects either the first analog video signals received by the first port or second analog video signals generated by the information handling system. A second port operably coupled to the embedded control logic transmits at least one of the  
20 first and second analog video signals to a master controller operably coupled to the information handling system.

In accordance with another embodiment of the present invention, an information handling system includes a  
25 first port for transmitting and receiving first video signals and a second port for transmitting and receiving second video signals. Embedded control logic is operably coupled between the first port and the second port. The embedded control logic selectively transmits to a master  
30 controller operably coupled to the information handling

system either the first video signals received from the first port or third video signals generated by the information handling system through the second port or the second video signals received from the second port or  
5 the third video signals generated by the information handling system through the first port.

In accordance with a further embodiment of the present invention, a method for managing multiple information handling systems using embedded control logic  
10 includes receiving first analog video signals from a first port and generating second analog video signals by an information handling system. Either the first analog video signals received from the first port or the second analog video signals generated by the information are  
15 selected and transmitted through a second port to a master controller operable coupled to the information handling system.

Important technical advantages provided by certain embodiments of the present disclosure include embedded  
20 control logic that provides scalability for a data center including multiple information handling systems. The embedded control logic is located in each of the information handling systems and controls what video signals, keyboard signals and mouse signals are  
25 communicated to a keyboard, monitor and mouse connected to the data center. Because the logic controlling the video displayed on the monitor is located in each of the information handling systems, additional information handling systems may be easily added to the data center  
30 without the need to buy additional hardware to manage the

added systems. Additionally, the embedded control logic does not limit the number of information handling systems that may be managed by a single monitor, keyboard and mouse.

5        Another important technical advantage provided by certain embodiments of the present disclosure includes embedded control logic that obtains operating information related to an information handling system. The embedded control logic includes a microcontroller in communication  
10 with the information handling system. Because the microcontroller is in direct communication with the information handling system, operating information such as an identification number, temperature of the information system, fan speed, internal voltage and the  
15 like may be communicated by the embedded control logic to be viewed by a system administrator at the monitor. Thus, the system administrator may determine if any hardware faults related to the operating information should be corrected.

20        All, some, or none of these technical advantages may be present in various embodiments of the present invention. Other technical advantages will be readily apparent to one skilled in the art from the following figures, descriptions, and claims.



BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present  
embodiments and advantages thereof may be acquired by  
referring to the following description taken in  
5 conjunction with the accompanying drawings, in which like  
reference numbers indicate like features, and wherein:

FIGURE 1 illustrates a block diagram of a data  
center having multiple servers that include embedded  
control logic in accordance with teachings of the present  
10 invention;

FIGURE 2 illustrates a block diagram of a data  
center having multiple servers that include bi-  
directional embedded control logic in accordance with  
teachings of the present invention;

15 FIGURE 3 illustrates a circuit diagram of embedded  
control logic included in a server in accordance with  
teachings of the present invention;

FIGURE 4 illustrates a circuit diagram of bi-  
directional embedded control logic included in a server  
20 in accordance with teachings of the present invention;  
and

FIGURE 5 illustrates a flow chart of a method for  
managing multiple information handling systems using  
embedded control logic in accordance with teachings of  
25 the present invention.

DETAILED DESCRIPTION

Preferred embodiments and their advantages are best understood by reference to FIGURES 1 through 5, wherein like numbers are used to indicate like and corresponding parts.

In particular, the present disclosure concerns a system and method for managing multiple information handling systems using embedded control logic. In some applications, such as data centers, multiple information handling systems may be used as web servers, mail servers, general purpose servers and storage servers. The information handling systems may be mounted in vertical racks that are managed by a system administrator by using a single keyboard, monitor and mouse.

The information handling system provided by the present disclosure includes embedded control logic that selectively transmits either keyboard, video and mouse signals generated by the information handling system or keyboard, video and mouse signals received from another information handling system in the rack. In one embodiment, the keyboard and mouse signals may be digital signals communicated on a shared digital communication bus and the video signals may be analog signals.

The embedded control logic selects the appropriate signals to transmit based on a signal received from a master controller operably coupled to at least one of the information handling systems. In one embodiment, the embedded control logic may include a multiplexer and a processing resource, such as a microcontroller, that generates control signals for the multiplexer based on a

signal received from the master controller. The processing resource may also obtain operating information, including but not limited to internal temperature, fan speed, operating voltage and an  
5 identification number, from the information handling system for communication to the master controller. In another embodiment, the embedded control logic may include at least two multiplexers such that the embedded control logic provides bi-directional communication of  
10 the keyboard, video and mouse signals.

For purposes of this disclosure, an information handling system may include any instrumentality or aggregate of instrumentalities operable to compute, classify, process, transmit, receive, retrieve,  
15 originate, switch, store, display, manifest, detect, record, reproduce, handle, or utilize any form of information, intelligence, or data for business, scientific, control, or other purposes. For example, an information handling system may be a personal computer, a  
20 network storage device, a server, or any other suitable device and may vary in size, shape, performance, functionality, and price. The information handling system may include random access memory (RAM), one or more processing resources such as a central processing  
25 unit (CPU) or hardware or software control logic, read only memory (ROM), and/or other types of nonvolatile memory. Additional components of the information handling system may include one or more disk drives, one or more network ports for communicating with external  
30 devices as well as various input and output (I/O)

devices, such as a keyboard, a mouse, and a video display. The information handling system may also include one or more buses operable to transmit communications between the various hardware components.

5 Referring now to FIGURE 1, data center 10 including embedded control logic that provides internal switching management for multiple information handling systems is illustrated. For illustrative purposes, the information handling systems are described below as servers. In  
10 other embodiments, any type of information handling system may include embedded control logic for providing internal switching management in a data center.

In the illustrated embodiment, data center 10 includes servers 12 interfaced with monitor 26, keyboard  
15 30 and mouse 34 through master controller 22. Servers 12, also labeled IHS\_1 through IHS\_n, represent a number n of servers which all may be mounted in a single rack. Cable 18 may connect IHS\_1 to IHS\_2 and cable 20 may connect IHS\_2 to IHS\_n such that servers 12 are daisy-  
20 chained together. Each of servers 12 may include embedded control (EC) logic 14 that functions to provide KVM switching intelligence in each of servers 12. In operation, EC 14 receives a selection signal from master controller 22 that selects the specific server to be  
25 monitored by a system administrator. Based on the selection signal, EC 14 transmits the keyboard, video and mouse signals (generally referred to as KVM signals) corresponding to the selected one of servers 12 to monitor 26 through master controller 22.

Monitor 26, keyboard 30 and mouse 34 may be used by a single IT person, such as a system administrator, to manage servers 12. In one embodiment, managing servers 12 may include viewing video from the selected server to perform various functions and execute various commands on the selected server. In another embodiment, managing servers 12 may also include obtaining operating information associated with the selected server to determine the health of the selected server.

10        Monitor 26 may be a liquid crystal device (LCD), cathode ray tube, or any other display device suitable for creating graphic images and alphanumeric characters recognizable to a user. Keyboard 30 may be any type of device used to input information into an information  
15        handling system, such as servers 12. Mouse 34 may be a roller mouse, optical mouse, wireless mouse or any other device that, when connected to a computer, allows a user to move a cursor around the display portion of monitor 26. Cable 16 may couple servers 12 to master controller  
20        22, and cables 24, 28 and 32 may respectively couple monitor 26, keyboard 30 and mouse 34 to master controller 22. Cables 16, 18, 20, 24, 28 and 32 (generally referred to as cables 16) may be CAT5, CAT6 or any other suitable generic impedance control twisted pair cables that may be  
25        used to communicate analog and/or digital signals. In one embodiment, cables 16 may include six (6) twisted pairs. Cables 16 additionally may be interfaced with ports (not expressly shown) in each of servers 12.

Master controller 22 may include any circuitry that  
30        operates to generate signals for selecting one of servers

12 for monitoring by a system administrator and receive analog video signals for display on monitor 26. In one embodiment, master controller 22 may be circuitry included in a plastic mold that is located separate from a rack holding servers 12. In another embodiment, master controller 22 may be mounted in one slot of a rack including servers 12 and may have the capability to communicate through an Ethernet connection such that monitor 26, keyboard 30 and mouse 34 may be located remotely from data center 10.

In operation, EC 14 provides keyboard, video and mouse (KVM) switching intelligence in each of servers 12 and transmits the appropriate KVM signals to master controller 22 for display on monitor 26 when one of servers 12 is selected for monitoring by a system administrator. The system administrator typically uses monitor 26, keyboard 30 and mouse 34 to select one of servers 12 to manage. In one embodiment, a list of servers 12 in data center 10 may be displayed on monitor 26. The system administrator may use either or both of keyboard 30 and mouse 34 to select the server to manage. In another embodiment, the system administrator may use keyboard 30 and/or mouse 34 to enter an identification number for one of servers 12. In either embodiment, master controller 22 generates a selection signal indicating which one of servers 12 has been selected for monitoring. Master controller 22 then communicates the selection signal to each one of servers 12 through cables 16 on a shared communication bus.

EC 14 located in each of servers 12 may receive the selection signal from master controller 22 and use the selection signal to transmit the appropriate KVM signals from the selected one of servers 12. For example, the  
5 selection signal may indicate that the system administrator has selected IHS\_2 for monitoring. Master controller 22 determines an identification number associated with the selected server and generates a selection signal to communicate to EC\_1 through EC\_n over  
10 cables 16.

Based on the selection signal, EC\_1 may determine that any video signals received on an input port should be transmitted to IHS\_2 through an output port. EC\_1, therefore, bypasses the video signals generated  
15 internally by IHS\_1. IHS\_2 receives the video signals transmitted from IHS\_1 through cable 18 on an input port. Since IHS\_2 was selected for monitoring, EC\_2 transmits the analog video signals generated internally by IHS\_2 on an output port. These video signals are then  
20 communicated to IHS\_n through cable 20. The video signals from IHS\_2 are further communicated for display on monitor 26 through cable 18, cable 16 and master controller 22. In one embodiment, master controller 22 may include a video buffer that allows the video signals  
25 to be communicated through cable 24 to monitor 26. EC 14 may also use the selection signal to determine the keyboard and mouse signals to communicate on the shared digital bus.

In another embodiment, data center 10 may include  
30 multiple racks of servers 12. The multiple racks may be

daisy chained together such that the video signals associated with any one of servers 12 may be displayed on monitor 26. For example, master controller 22 may be interfaced with a server located in the top slot of a first rack. The server may be connected to other servers located in lower slots of the first rack through daisy changed cables. A cable interfaced with a port of the server located in the bottom slot of the first rack may connect the servers in the first rack with a server located in the first slot of a second rack. The remaining servers in the second rack may then be daisy chained to the first server. Thus, a system administrator at monitor 26 may view video signals and use keyboard and mouse signals from any of the servers in either of the first or second racks. Since each of servers 12 may include embedded control logic, data center 10 may be scalable such that additional servers 12 may be added without the need to add any extra circuitry to monitor the servers.

Once master controller 22 receives the KVM signals, the system administrator may monitor the selected server (e.g., IHS\_2 as described above). The analog video signals received from master controller 22 may be displayed on monitor 46 and the digital keyboard and mouse signals may be respectively used by keyboard 30 and mouse 34. The system administrator may then perform any management activity for IHS\_2 by using monitor 26, keyboard 30 and mouse 34.

FIGURE 2 illustrates a block diagram of another example embodiment of a data center that includes



embedded control logic. Data center 40 includes servers  
12 interfaced with monitor 26, keyboard 30 and mouse 34  
through master controller 22. As described above in  
reference to FIGURE 1, servers 12, also labeled IHS\_1  
5 through IHS\_n, represent a number n of servers which all  
may be mounted in a single rack.

In the illustrated embodiment, cable 18 connects  
IHS\_1 to IHS\_2, cable 20 connects IHS\_2 to IHS\_n-1 and  
cable 21 connects IHS\_n-1 to IHS\_n. Additionally, master  
10 controller 22 is connected to IHS\_1 by cable 16 and to  
IHS\_n by cable 44 such that the KVM signals from servers  
12 may be communicated to monitor 26 through multiple  
paths. The additional path closes the loop and may  
create a ring topology. The loop allows a single point  
15 of failure (e.g., one of cables 18, 20 and 21 is  
disconnected or one of servers 12 is inoperative) in data  
center 12 but still allows the KVM signals for a selected  
server to be communicated to monitor 26. In other  
embodiments, additional cables may be connected to  
20 different servers in data center 10 (e.g., another cable  
may directly connect master controller 22 to IHS\_n-1) to  
create a combination ring and star topology. This allows  
for further redundancy in data center 10.

Each of servers 12 may include bi-directional  
25 embedded control logic (BEC) 42 that functions to provide  
KVM switching intelligence in each of servers 12.  
Similar to EC 14 as described above in reference to  
FIGURE 1, BEC 42 transmits the appropriate analog video  
signals to monitor 26 through master controller 22 when  
30 one of servers 12 is selected for monitoring by a system

administrator. When the system administrator selects a server to manage using monitor 26, keyboard 30 and/or mouse 34, master controller 22 generates a selection signal based on an identification number associated with the selected server and communicates the selection signal to servers 12 through cables 16, 18, 20, 21 and 44 on a shared communication bus.

Each of servers 12 may receive the selection signal from master controller 22 and use the selection signal to transmit the appropriate KVM signals from one of servers 12. For example, the selection signal may indicate that the system administrator has selected IHS<sub>n-1</sub> for monitoring. Master controller 22 transmits the selection signal over cables 16 and 44 to the respective the respective ports for IHS<sub>1</sub> and IHS<sub>n</sub> interfaced with cables 16 and 44. Based on the control signal, BEC<sub>1</sub> determines that the analog video signals received on a first port should be transmitted to IHS<sub>2</sub> through a second port. The analog video signals generated internally by IHS<sub>1</sub>, therefore, are bypassed. Additionally, BEC<sub>n</sub> determines that the video signals received on a first port should be transmitted to IHS<sub>n-1</sub> through a second port and bypasses the video signals generated internally by IHS<sub>n</sub>. IHS<sub>2</sub> receives the video signals from IHS<sub>1</sub> through cable 18 on a first port. Again, since IHS<sub>2</sub> was not selected for monitoring, BEC<sub>2</sub> bypasses the video signals generated internally by IHS<sub>2</sub> and transmits the video signals received from IHS<sub>1</sub> on the first port to IHS<sub>n-1</sub> via a second port.

IHS<sub>n-1</sub> receives the video signals from IHS<sub>2</sub> through cable 20 and the video signals from IHS<sub>n</sub> through cable 21. Since the system administrator selected to manage IHS<sub>n-1</sub>, BEC<sub>n-1</sub> communicates the analog video signals generated internally by IHS<sub>n-1</sub> over either or both of the ports associated with IHS<sub>n-1</sub>. The internal video signals from IHS<sub>n-1</sub> may be communicated back to master controller 22 via one of two paths. First, the video signals may be communicated through cables 21 and 44. Second, the video signals may be communicated through cables 20, 18 and 16. The possibility of two different paths for the video signals to be communicated back to master controller 22 provides fault tolerance for data center 40. For example, the system administrator may remove cable 18 and/or IHS<sub>2</sub> may be disabled. In either case, the video signals cannot be communicated to master controller 22 through cable 16 since the path has been disconnected. The video signals, however, may still be communicated to master controller 22 through cable 44.

Once master controller 22 receives the video signals, a system administrator at monitor 26 may view the video associated with the selected server (IHS<sub>n-1</sub>). The system administrator may then perform any management activity for IHS<sub>n-1</sub>.

As described above in reference to FIGURE 1, multiple racks including servers 12 may be connected such that the servers in all racks may be managed through monitor 26, keyboard 30 and mouse 34. The servers in each rack may include BEC 42 and one or more cables may be used to directly connect master controller 22 to one

or more servers in the multiple racks. As described above, the multiple connections between master controller 22 and servers 12 in the multiple racks may provide fault tolerance in data center 40. The multiple connections to  
5 master controller 22 may additionally allow more than one server to be monitored at one time by the system administrator.

FIGURE 3 illustrates a circuit diagram of embedded control logic that provides internal KVM switching  
10 management for multiple servers. EC 14 includes ports 50 and 51, mux 52 and processor 60. Cables, as described above in reference to FIGURE 1, may interface with ports 50 and 51. In one embodiment, the cables may include six twisted pairs. Video signals 53 may be transmitted on  
15 four of the six twisted pairs of the cable interfaced with port 50 and video signals 54 may be transmitted on four of the six twisted pairs of the cable interfaced with port 51. Shared bus 56 may be transmitted over the remaining two pairs in the cables interfaced with ports  
20 50 and 51. As shown, shared bus 56 may provide a direct path between ports 50 and 51. Shared bus 56 may be a RS485 bus, a CAN bus or any other multidrop digital communication bus that allows transmission of digital signals between processor 60 and master controller 22.  
25 Shared bus 56 may communicate signals including, but not limited to, keyboard and mouse signals and various communication signals between master controller 22 and servers 12. In other embodiments, the cables may include any number of twisted pairs such that the video signals  
30 and shared bus 56 may be communicated simultaneously.

Mux 52 may be any analog mux having buffered inputs and outputs. In other embodiments, mux 52 may be any mux that transmits analog video signals generated internally by servers 12 such that no analog to digital conversion  
5 is necessary. In the illustrated embodiment, mux 52 may be a two-to-one mux having two inputs for receiving video signals 53 from port 50 and video signals 58 generated by servers 12 and one output for transmitting video signals 54 to port 51. In one embodiment, video signals 53, 54  
10 and 58 may be RGB signals including a sync signal. In other embodiments, video signals 53, 54 and 58 may be any type of analog video signals generated by servers 12 that may be displayed on monitor 26.

Processor 60 may be a microprocessor, a  
15 microcontroller, a digital signal processor (DSP) or any other digital circuitry configured to process digital signals received from shared bus 56 and internal bus 62. Processor 60 may be interfaced with shared bus 56, internal bus 62 and mux 52. Internal bus 62 may be an I<sup>2</sup>C  
20 bus or any other bus configured to communicate signals between processor 60 and other components in servers 12.

As described above in reference to FIGURE 1, EC 14 may be included in each of servers 12. A system administrator using monitor 26, keyboard 30 and mouse 34  
25 may select one of servers 12 to manage. Master controller 22 may generate a selection signal based on an identification number associated with the selected server and communicate the selection signal over shared bus 56. Processor 60 may receive the selection signal from shared

bus 56 through port 50 or 51 and generate mux signal 64 and disable signal 66 based on the selection signal.

If processor 60 determines that the server containing EC 14 was selected to be managed, processor 60  
5 generates mux signal 64 such that video signals 58 generated by the selected server are transmitted to the output of mux 52. If processor 60 determines that the server containing EC 14 was not selected, processor  
10 generates disable signal 66 such that video signals 53 received from port 50 are transmitted to the output of mux 52. Therefore, either video signals 53 or video signals 58 may be transmitted as video signals 54 on port 51 such that the appropriate video signals may be communicated for viewing on monitor 26.

15 In some embodiments, processor 60 may query other components of servers 12 to determine operating information associated with servers 12. For example, the operating information may include, but is not limited to, the internal operating temperature of servers 12,  
20 operating speed of any fans in servers 12 and the core voltage level of servers 12. Processor 60 may communicate the operating information to master controller 22 over shared bus 56. Processor 60 may additionally receive low bandwidth control information  
25 over shared bus 56 from keyboard 30 and mouse 34 and translate the information into the appropriate keyboard and mouse commands to execute various commands in servers 12.

EC 14 may additionally include backup power signal  
30 68 generated by backup power source 67. Backup power

signal 68 may provide a power source for processor 60 and mux 52 when the server including EC is powered down. Backup power signal 68, therefore, may allow a system administrator to monitor video from the powered down  
5 server. Additionally, backup power signal 68 may prevent the communication path for the video signals from being broken if one of servers 12 is powered down. In one embodiment, AC power connected to the server may be disconnected. Backup power source 67 may generate backup  
10 power signal 68 using the backup power provided through the cables interfaced with ports 50 and 51.

FIGURE 4 illustrates a circuit diagram of bi-directional embedded control logic that provides internal KVM switching management for multiple servers. BEC 42  
15 includes ports 70 and 71, muxes 72 and 73 and processor 74. Cables, as described above in reference to FIGURE 1, may interface with ports 70 and 71. In one embodiment, the cables may include six twisted pairs. Video signals 76 may be transmitted on four of the six twisted pairs of  
20 the cable interfaced with port 70 and video signals 78 may be transmitted on four of the six twisted pairs of the cable interfaced with port 71. Shared bus 80 may be transmitted over the remaining two pairs in the cables interfaced with ports 70 and 71. As shown, shared bus 56  
25 may provide a direct path between ports 70 and 71. Shared bus 80 may be a RS485 bus, a CAN bus or any other multidrop digital communication bus that allows transmission of digital signals. Shared bus 80 may communicate signals including, but not limited to,  
30 keyboard and mouse signals and various communication

signals between master controller 22 and servers 12. In other embodiments, the cables may include any number of twisted pairs such that the video signals and shared bus 80 may be communicated simultaneously.

5           Muxes 72 and 73 may be any analog mux having buffered inputs and outputs. In other embodiments, muxes 72 and 73 may be any mux that transmits analog video signals generated internally by servers 12 such that no analog to digital conversion is necessary. In the  
10 illustrated embodiment, muxes 72 and 73 may be a two-to-one muxes having two inputs for receiving video signals 76 from port 70, video signals 78 from port 71 and video signals 82 internally generated by servers 12 and an output for transmitting video signals 76 to port 70 and  
15 video signals 78 to port 71. In one embodiment, video signals 76, 78 and 82 may be RGB signals including a sync signal. In other embodiments, video signals 76, 78 and 82 may be any type of analog video signals generated by servers 12 that may be displayed on monitor 26.

20           Processor 74 may be a microprocessor, a microcontroller, a digital signal processor (DSP) or any other digital circuitry configured to process digital signals received from shared bus 80 and internal bus 84. Processor 74 may be interfaced with shared bus 80,  
25 internal bus 84 and muxes 72 and 73. Internal bus 84 may be an I<sup>2</sup>C bus or any other bus configured to communicate signals between processor 74 and other components in servers 12.

As described above in reference to FIGURE 2, BEC 42  
30 may be included in each of servers 12. A system



administrator using monitor 26, keyboard 30 and mouse 34 may select one of servers 12 to manage. Master controller 22 may generate a selection signal based on an identification number associated with the selected server  
5 and communicate the selection signal over shared bus 80. Processor 74 may receive the selection signal from shared bus 56 through port 70 or 71 and generate mux signals 86 and 88 and disable signals 90 and 92 based on the selection signal.

10 If processor 74 determines that the server containing BEC 42 was selected to be managed, processor 74 generates either or both of mux signals 86 and 88 such that video signals 82 generated by the selected server are transmitted to the outputs of mux 72 and 73. If  
15 processor 74 determines that the server containing BEC 42 was not selected, processor generates either or both of disable signals 90 and 92 such that video signals 76 received from port 70 are transmitted to the output of mux 72 and/or video signals 78 received from port 71 are  
20 transmitted to the output of mux 73. Therefore, either video signals 76 or video signals 82 may be transmitted as video signals 78 on port 71 and/or either video signals 78 or video signals 82 may be transmitted as video signals 76 on port 70 such that the appropriate  
25 video signals may be communicated for viewing on monitor 26.

In one embodiment, processor 74 may generate mux signals 86 and 88 such that video signals 82 generated by the selected server are transmitted to the output of mux  
30 72 and video signals 78 received on port 71 are

transmitted to the output of mux 73. BEC 42, therefore, may allow the video from more than one of servers 12 to be displayed on monitor 26.

Similar to processor 60 in EC 14 illustrated in  
5 FIGURE 3, processor 74 also may query other components of servers 12 to determine operating information associated with servers 12. For example, the operating information may include, but is not limited to, the internal  
operating temperature of servers 12, operating speed of  
10 any fans in servers 12 and the core voltage level of servers 12. Processor 74 may communicate the operating information to master controller 22 over shared bus 80. Processor 74 may additionally receive low bandwidth  
control information over shared bus 80 from keyboard 30  
15 and mouse 34 and translate the information into the appropriate keyboard and mouse commands to execute various commands in servers 12.

BEC 42 may additionally include backup power signal  
94 generated by backup power source 96. Backup power  
20 signal 94 may provide a power source for processor 74 and muxes 72 and 73 when the server including BEC is powered down. Backup power signal 94, therefore, may allow a system administrator to monitor video from the powered  
down server. Additionally, backup power signal 94 may  
25 prevent the communication path for the video signals from being broken if one of servers 12 is powered down. In one embodiment, AC power connected to the server may be disconnected. Backup power source 96 may generate backup  
power signal 94 using the backup power provided through  
30 the cables interfaced with ports 70 and 71.

FIGURE 5 illustrates a flow chart of a method for managing multiple information handling systems using embedded control logic. Generally, a data center may include multiple servers that may be managed through a single set of peripherals in a one-to-many relationship. The servers may include embedded control logic that provides KVM switching capability for each server. The embedded control logic uses a selection signal from a master controller to determine what KVM signals should be communicated to the peripherals. If the embedded control logic determines that the server has been selected, the embedded control logic transmits the analog video signals generated internally by the selected server to the master controller. Otherwise, the embedded control logic transmits video signals received from another server in the data center.

At step 100, a system administrator using monitor 26, keyboard 30 and mouse 34 selects a server to monitor. In one embodiment, a list of servers 12 may be displayed on monitor 26 and the desired server may be selected by using keyboard 30 and/or mouse 34. In another embodiment, the system administrator may enter an identification number or address associated with the desired server using keyboard 30. In a further embodiment, a server may be selected from a pull down menu using keyboard 30 and/or mouse 34.

The identification number and/or address associated with the selected server is communicated to master controller 22 at step 102. Master controller 22 generates a selection signal using the identification

number and/or address. Master controller 22 then communicates the selection signal to embedded control logic in servers 12 through the cables connecting master controller 22 to servers 12. At step 104, servers 12  
5 receive the selection signal. As described above in reference to FIGURES 3 and 4, the selection signal may be received by a processor in the embedded control logic located each of servers 12 from a shared bus. The processor in the embedded control logic uses the  
10 selection signal to generate a mux signal at step 106. The mux signal enables a mux included in the embedded control logic, which selects the appropriate video signals to communicate to monitor 26.

At step 108, servers 12 including the embedded  
15 control logic determine the server selected for monitoring by a system administrator. If the server was not selected for monitoring, the processor generates a disable signal that enables transmission of the video signals received from another server in the data center  
20 at step 110. If the server was selected for monitoring, the processor generates a mux signal that enables transmission of the video signals generated internally by the selected server at step 112.

At step 114, master controller 22 receives the video  
25 signals and keyboard and mouse signals over the shared bus from the selected server. The video signals are communicated to monitor 26 such that a system administrator may view video from the selected server at step 116. The system administrator may, therefore, view  
30 the video generated by the selected server.

Although the disclosed embodiments have been described in detail, it should be understood that various changes, substitutions and alterations can be made to the embodiments without departing from their spirit and  
5 scope.